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Storm et al.

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[54] **HOLDER AND ACTUATOR MEANS FOR SURGICAL INSTRUMENTS**

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[52] **U.S. Cl.** ..... **30/228**; 30/272 A; 128/305; 128/318; 310/32

[51] **Int. Cl.**[2] **B26B 7/00**; B26B 15/00

[58] **Field of Search** ..... 30/228, 180, 241, 272 A, 30/272 R; 128/305, 314, 315, 318; 310/31, 32; 15/22 R

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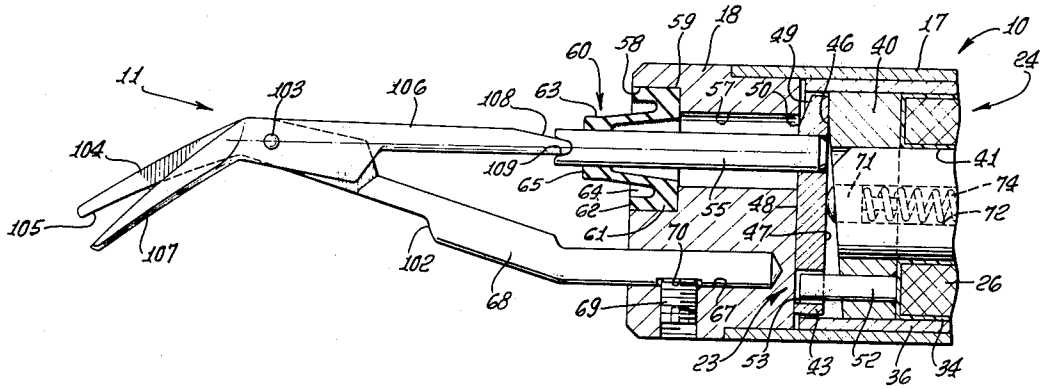
[57] **ABSTRACT**

A combined holder and actuator means to which various types of instruments used in surgery may be attached; such instruments including scissors type and blade type. A holder and actuator means for such instruments constructed to permit autoclaving under conditions of high temperature and pressure. The actuator means imparts precise minute motion strokes to an instrument for cutting, piercing, or otherwise penetrating epidermis, membrane, or tissue. In one example, a precisely limited pivoted element actuates the instruments, in another example, a linearly reciprocal element provides the precise motion stroke.

8 Claims, 6 Drawing Figures



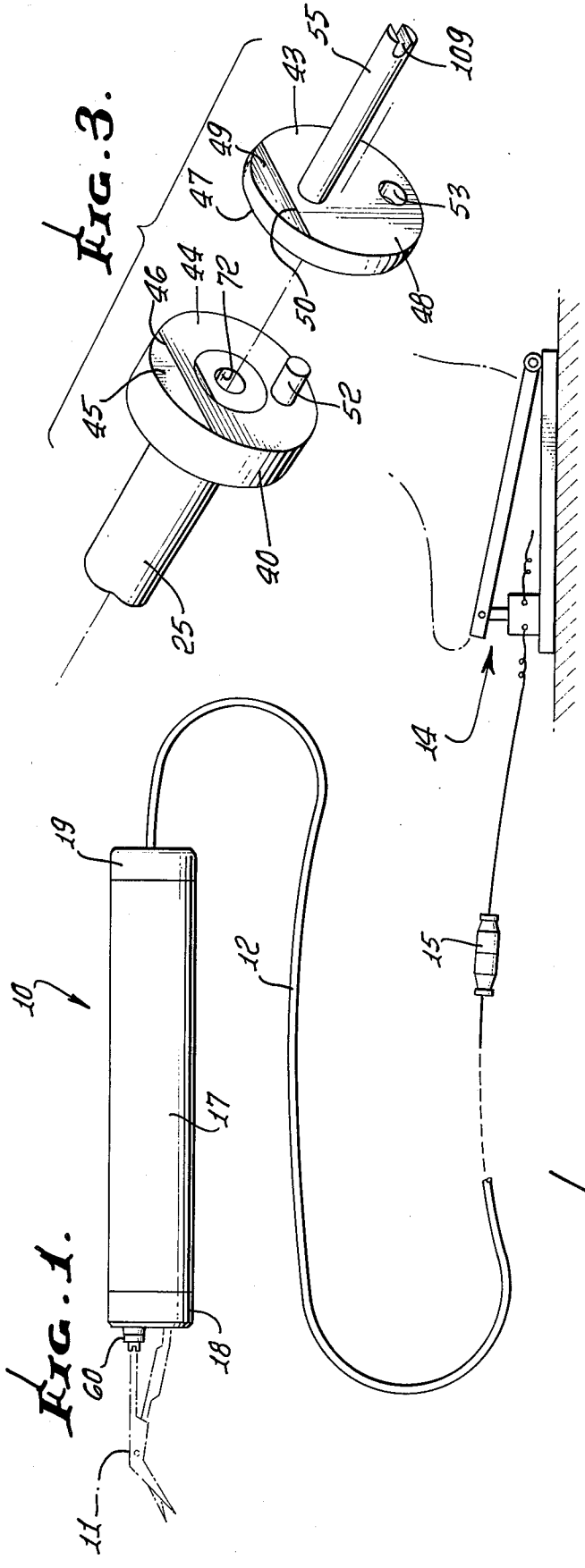


FIG. 1.

FIG. 3.

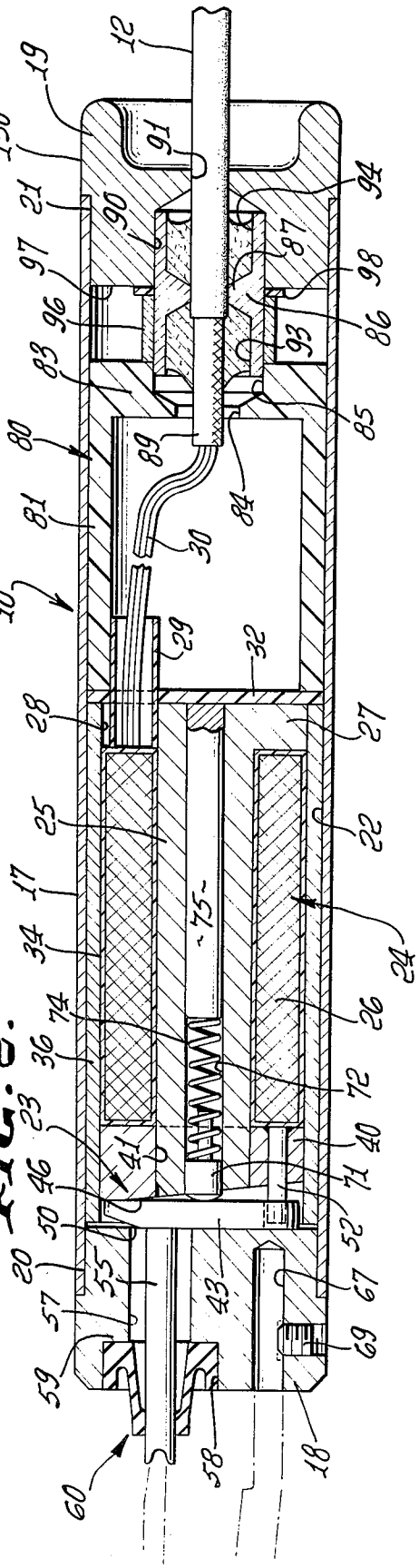


FIG. 2.

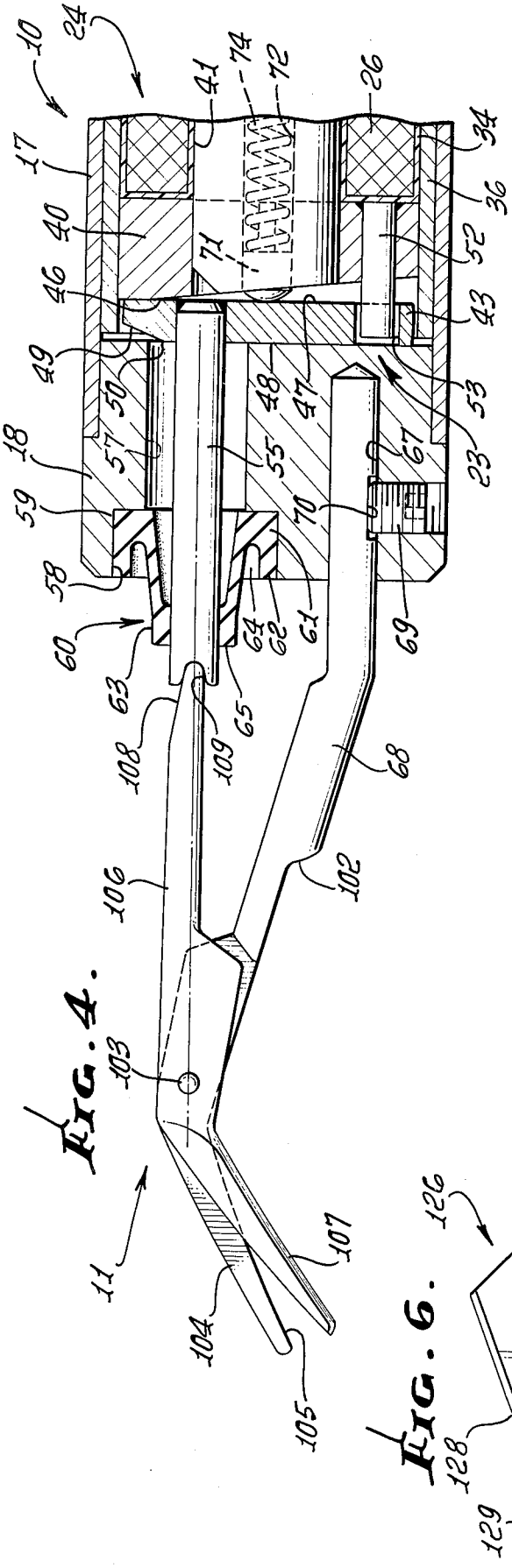


FIG. 4.

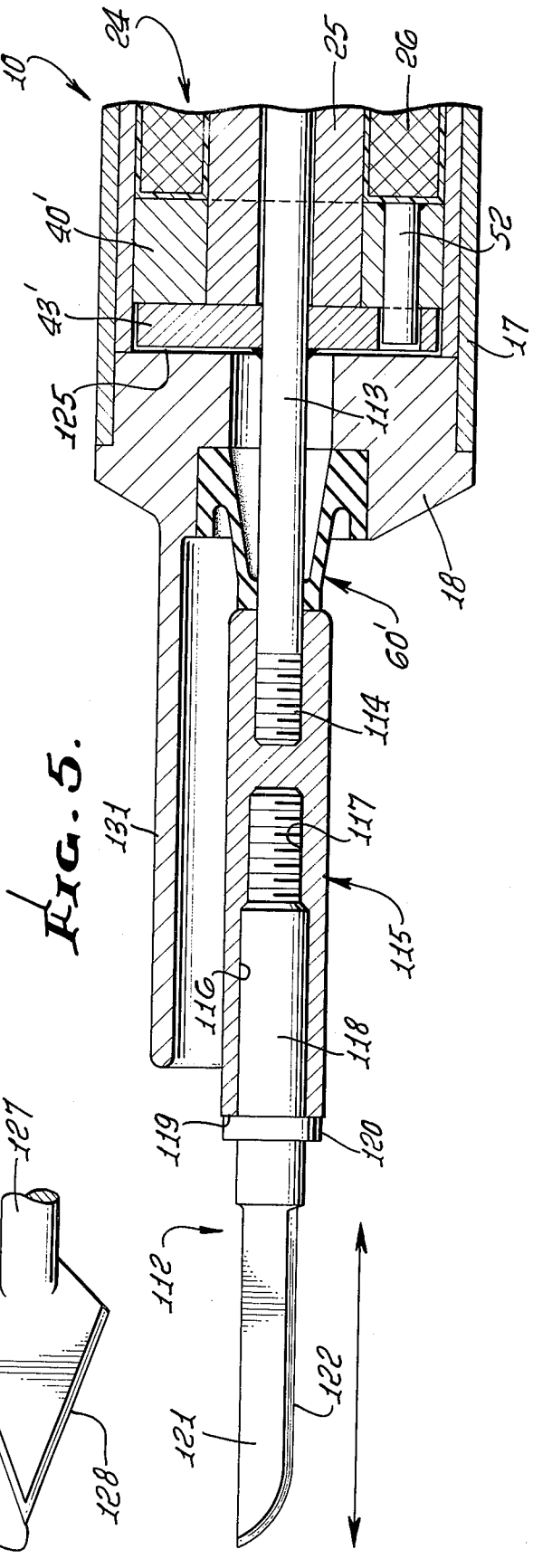


FIG. 5.

FIG. 6.

HOLDER AND ACTUATOR MEANS FOR SURGICAL INSTRUMENTS

BACKGROUND OF THE INVENTION

Use of surgical instruments requires an extremely high degree of care and skill by an experienced, trained surgeon. A skilled surgeon is capable of manually manipulating a surgical instrument to precisely cut to desired depth and length into and through outer and inner layers or coverings or tissues of a body during the performance of an operation thereon. Such surgical instruments are extremely sharp, precisely contoured for the cutting purpose intended, and must be maintained in sterile condition. After use such instruments must be capable of sterilization under conditions of high temperature to destroy any bacteria thereon. Extremely high standards have been set by surgeons, hospitals, and health authorities for surgical instruments and their use in operations on the human body.

Surgery, on any part of the human body, is a delicate matter and perhaps one of the most sensitive areas upon which surgery may be performed is that of the eye. Opthamologists have occasion to cut around the cornea of the eye, to cut through various eye tissue in connection with repair of the retina, and to remove cataracts. When cutting into the eye or eyeball structure, it is apparent the cutting line may be of three dimensional curved configuration and a precise cut demands utmost skill of the eye surgeon.

It has been proposed to employ surgical manually-operated scissors for cutting through outer covering layers or tissue of the eyeball. Cutting by manual scissors often leaves a jagged line because of the incremental reciprocal cutting action imparted to the scissors and the hesitation inherent in a scissors action when the scissors members are repositioned for the successive cut. Jagged, irregular cutting lines are undesirable with respect to such eye surgery because of the difficulty of precisely matching the cut edges after completion of the operation and the resultant increased time for healing.

It is also desirable that surgical instruments, such as scissors and knives, be relatively small and lightweight to permit easy manipulation and to be readily held by a surgeon's hand. Such small size imposes restrictions on the size of the elements to be electrically actuated and the amount of power transmitted thereto.

SUMMARY OF THE INVENTION

The present invention relates to and contemplates a small, lightweight, electrically actuated holder and actuator means with which various surgical instruments may be attached and operated so that a cutting blade or cutting scissors members are actuated in such a manner that a precise line of cut in tissue or other layers of the human body amy be readily made and surgical cutting performed in a highly skilled manner and superior result. The invention contemplates a novel surgical instrument holder and actuator in which motion imparted to the cutting blade or cutting scissors is precisely controlled and restricted so that a surgeon need only direct the cutting blade along the selected line of cut.

It is therefore a primary object of the present invention to provide a novel holder and actuating means for surgical instruments.

An object of the present invention is to provide a surgical instrument holder and actuator means which is constructed to permit autoclaving of the holder and actuator means without damage to motion imparting means provided in the holder.

Another object of the present invention is to provide a holder and actuator means for surgical instruments which is readily adapted for use with single blade type surgical instruments or scissors type surgical instruments.

A further object of the invention is to provide a holder and actuator means for instruments wherein motion imparted to the instrument is precisely accurately controlled, so that a uniform fine cut may be made in the body tissue upon which the instrument is being used.

A still further object of the present invention is to provide a surgical instrument holder and actuator means wherein motion imparting means carried thereby is readily adapted to provide linear reciprocal motion or pivotal reciprocal motion.

Still another object of the present invention is to provide an instrument holder and actuator means which is small and lightweight to permit precise manipulation and control of the instrument held thereby under conditions of delicately performed surgery.

A further object of the invention is to provide such an instrument holder and actuator means which is small and lightweight and electrically actuated, and wherein the design of the actuator means minimizes frictional losses and minimizing power requirement.

Generally speaking, the actuator and holder means of this invention includes a pin member adapted to be attached to an instrument to impart motion to an instrument member. The pin member is carried by a transversely disposed element which is subject to restricted vibratory, oscillatory or reciprocal motion imparted to it by electrical solenoid means, the length of the stroke being preselected and controlled by location of stop surfaces. The electrical and mechanical parts of the holder and actuating means are sealed and protected to permit autoclaving.

Other objects and advantages of the present invention will be readily apparent from the following description of the drawings in which an exemplary embodiment of the invention are shown.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic general view of a holder and actuating means embodying this invention and connected with a foot actuated switch for operation.

FIG. 2 is an enlarged sectional view taken in a longitudinal plane bisecting the holder and actuator means shown in FIG. 1.

FIG. 3 is an enlarged perspective and exploded view of motion transferring or imparting elements used in the holder and actuator means.

FIG. 4 is an enlarged fragmentary sectional view taken in the same plane as FIG. 2 illustrating the connection of a surgical scissors to the holder and actuator means of this invention.

FIG. 5 is a view similar to FIG. 4, and shows a modification of the holder and actuator means for adaptation to a single surgical blade member to which linear reciprocal motion is imparted.

FIG. 6 is a fragmentary elevational view of a different type of surgical blade which may be used with the modification shown in FIG. 5.

DETAILED SPECIFICATION

In FIG. 1 a surgical instrument holder and actuator means embodying this invention is generally indicated at 10. Actuator means 10 is adapted to operably receive a surgical instrument 11 indicated in phantom lines and of surgical scissors type. The holder and actuator means 10 includes a shielded jacketed electrical cable 12 which may be connected to a foot switch generally indicated at 14 by a suitable separable electrical coupling 15. The holder and actuator means 10 without the surgical scissors 11 and including electrical cable 12 and part of coupling 15, is constructed and arranged to be autoclaved, that is, sterilized under conditions of steam temperatures of about 270 degrees F, and selected suitable pressure. Such construction of the holder and actuator means 10, cord 12, and coupling 15 is designed to meet and satisfy tests required to give this product a Class A rating by the City of Los Angeles Electrical Testing Laboratory, the same rating as that required for heart "pacemakers."

The holder and actuator means 10 is of a size adapted to readily be held by the hand of a surgeon, an exemplary length of the actuator means being 3½ inches and a diameter of about five-eighths inch. The actuator means may thus be readily held as if it were a pen, a pencil, or a scribing tool.

The holder and actuator means 10 comprises an elongated, hollow, open-ended cylindrical member 17 and end closure members 18 and 19. Each end closure member may have an outer diameter corresponding to the outer diameter of cylinder member 17, and may be provided with annular recesses 20 and 21, respectively, for snugly receiving end portions of cylindrical member 17. Each of members 17, 18 and 19 is preferably made of stainless steel.

The members 17, 18 and 19 provide a hollow cylindrical chamber 22 within which is housed an actuator means, generally indicated at 23, for imparting motion to a surgical instrument. In this embodiment, actuator means 23 within the front half portion of chamber 22, includes a solenoid 24 comprising a central coaxial longitudinally extending core member 25 of iron or other magnetic material surrounded over a major portion of its length by a coil 26. Member 25 has an inner end provided with a radial flange 27, interrupted by a cut-out 28, for passage therethrough in a tubular member 29 of electrical leads 30 from the coil 26. Tubular member 29 may be of suitable dialectric material. The end face of core member 25 and flange 27 may seat against a spacer disc 32, also of suitable dialectric material. The coil 26 is encased in insulation material indicated at 34 for the purpose of providing double insulation of the coil. Enclosing the coil 26 is an internal iron sleeve 36, press fitted to flange 27 and having one end face seated against the disc 32 adjacent to the center of chamber 22, and having its other end face spaced from the internal planar face of the front end closure 18. Such spacing may be about 0.010 inches and permits precise adjustment of the actuator means during assembly as later described.

Actuator means 23 also includes, in the space between the front end closure member 18 and the front end of core 26, a front end core element 40 preferably made of brass and having a central bore 41 receiving the axial core portion 25. In the space between the rear surface of front end closure member 18 and the forwardly directed surface of core element 40, a circular disc-like flapper element 43 is positioned for limited restricted pivotal or hinge-like movement.

The arrangement of flapper element 43 and core element 40 which permits pivotal or hinging movement of the flapper element is best seen in FIG. 3. Core element 40 is provided with a partially truncated end face 44 lying in a plane inclined to the axis of the core element 40 of about three degrees, the plane intersecting with the right angle or normal face portion 45 of the core element at a chord line 46 above the through bore of the core element 40. The back face 47 of flapper element 43 is planar and normal to the axis of the element 43 and core element 40. To afford the limited pivotal movement of flapper element 43 about hinge line 46, front face 48 of the flapper element is beveled at 49 at about 10 degrees to provide a truncated surface defined by chord line 50 which is spaced from the axis of flapper element 43 the same distance as chord line 46 is spaced from the axis of core element 40.

To maintain the chord lines 46 and 50 in parallel relation and to prevent relative rotation of flapper element 43 and core element 40, core element 40 is provided with a forwardly extending registration or guide pin 52 diametrically opposite chord line 46 as shown, but the registration pin may be located elsewhere to minimize friction forces. Flapper element 43 is provided with an aligned through opening 53 for loose reception of pin 52 in assembly. The tolerance between pin 52 and the inner surface of opening 53 are sufficient to afford pivotal or hinge movement of flapper element 43 about hinge line 46.

An instrument connecting pin or member 55 is carried by and projects forwardly from the front surface of flapper element 43 from a location between the axis of flapper element 43 and the chord line 50. The axis of connecting pin 55 intersects the radius of element 43 which is normal to the chord line 50. Thus, movement imparted to connecting pin 55 will lie in a longitudinal plane which includes the axes of pin 55, element 43, and opening 53, said axes defining a plane normal to chord line 50 and hinge line 46.

Front end closure element 18 is provided with a through bore 57 through which connecting pin 55 extends and terminates at a point beyond the front face of front closure 18. The diameter of bore 57, may be approximately twice the diameter of connecting pin 55 to afford free movement of pin 55 therein. Through bore 57 includes an enlarged front bore portion 58 defining an annular recess and shoulder 59 which provides a seat for a sealing member 60.

Sealing member 60 comprises a base portion 61 seated on shoulder 59 and having a forwardly extending outer cylindrical wall 62 defining with a forwardly extending inner conical portion 63 an annular forwardly facing recess 64. The conical portion 63 has radially inwardly extending flanges 65 which tightly fit around pin 55. Sealing member 60 thereby provides a relatively thin, flexible, conical wall portion 63 which readily permits lateral and longitudinal motion of connecting pin 55 as imparted to it by flapper element 43.

The above described construction of the sealing member 60 not only permits the connecting pin to transmit motion from flapper element 43, but also pro-

vides a seal means capable of sealing bore **57** under conditions of autoclaving or steam and pressure sterilization. Under such conditions of pressure, it will be apparent that fluid pressure in annular recess **64** will be exerted both radially outwardly and radially inwardly against the closure element **18** and the pin **55**, respectively, to enhance the sealing characteristics of sealing member **60**.

The front end closure member **18** also includes a hole **67** extending a selected suitable depth into member **18** for slidable reception of an instrument or tool part **68**. Tool part **68** may be retained and fixed in relation to front end closure member **18** by a set screw means **69**.

Means for imparting forward and back motion (including major longitudinal and minor lateral motion components) to flapper element **43** and its rigidly connecting pin **55** is provided not only by the solenoid means **24** but also by a headed slide pin **71** movable in an axial bore **72** of core member **25**. Headed pin **71** is biased against the back face of flapper element **43** by a suitable coil spring **74** seated at one end against the head of pin **71** and at its other end against a spacer rod **75**. Spacer rod **75** is fixed in bore **72** by a press fit or by suitable adhesive.

In operation, when solenoid means **24** is energized, the flapper element **43** will be reciprocated, backwardly by the attraction of the electromagnetic flux of the solenoid **24** and forwardly by the spring biased headed slide pin **71**. The rate of reciprocation imparted to the flapper element **43** and connecting pin **55** may be a rapid vibration of selected frequency, such as **60** c.p.s. or **120** c.p.s. so as to actuate the surgical instrument as further described.

The rearward chamber portion of the holder and actuator means **10** is primarily arranged for providing electrical connections to solenoid means **24**, a seal for the back end of the holder and actuator means **10** capable of withstanding autoclaving, and a means for precise assembly of core element **40** and flapper element **43** with respect to the back face of the front end closure member **18**. Within the back portion of chamber **22** may be provided an elongated cup-shaped member **80**, including a cylindrical wall **81** having an outer diameter closely slideably fitted within the cylinder member **17**. The front end of cylindrical wall **81** is open and receives therewithin tubular member **29** from solenoid means **24** which provides a passageway for leads **30**. The front edge wall of the cylindrical wall **81** seats against a spacer disc **32**. An end wall **83** includes a central opening **84** enlarged at its back portion **85** to partially receive one end of a brass fitting **86**. Brass fitting **86** has a ported central partition **87** through which may pass cable **12** including the outer covering of cable **12**. Inwardly of ported partition **87** outer covering of cable **12** may be striped to the braided portion **89** of the cable to facilitate splicing. The back end of fitting **86** extends into an aligned opening **90** provided in end closure member **19**, opening **90** having an axial port **91** for cable **12**. On opposite sides of central partition **87** of fitting **86**, the chambers **93** and **94** may be filled with a suitable silastic material providing a tight leak-proof seal for cable **12** under conditions of autoclaving.

In FIG. **2** it will be apparent that end closure members **18**, **19** tightly abut end faces of cylinder member **17** when assembled. Cylindrical sleeve **36**, transverse spacer disc **32** and cup-shaped member **80** are in abutment with each other and cylinder sleeve **36** is in abutment with front end closure member **18**. The base wall **83** of cup-shaped member **80** provides a seat for a spacer sleeve **96** which encircles fitting **86**. Between the back edge face of sleeve **96** and the front end face **97** of the back end closure member **19** are provided one or more shims **98** to provide a precise selected clearance of about **0.010** inches.

Electric cable **12** may be coupled to the foot switch **14** through coupling **15** as previously indicated. Foot switch **14** may be any convenient well-known type of foot switch and may be connected to a suitable power supply (not shown.) Such a power supply should be capable of energizing the solenoid means **24** so as to provide reciprocal motion of the flapper element and connecting pin at rates of **60** to **120** cycles per second or some other desired frequency.

A surgical instrument **11** of scissors type and its adaptation to the holder and actuator means **10** is best shown in FIG. **4** where scissors **11** includes a stationary non-movable instrument member **68** which is fixed and received in the end closure member **18** by the set screw **69**. Member **68** may have a flatted recess **70** to receive the end of the set screw. The instrument member **68** includes an intermediate portion **102** inclined toward the axis of the holder and actuator means and which provides a pivot axis **103** located on or proximate to the projection of the axis of the connecting pin **55**. The scissors member **68** also includes a cutting blade portion **104** which forms an obtuse angle with the intermediate portion **102** and provides a fixed stationary cutting edge **105** of selected shape and configuration depending upon the type of surgery to be performed.

Scissors **11** also includes a movable scissors member **106** pivoted about axis **103** and having a cutting blade portion **107** extending along and in angular relation to the cutting blade **104** of the fixed scissors member. Scissors member **106** includes a tapered end portion **108** adapted to be received within a transverse notch **109** provided in the end of connecting pin **55**. The shape of the surfaces on the end portion **108** of the scissors member **106** provides unrestrained relative rocking motion between the surfaces of the notch **109** and the end portion **108**. Preferably, axis **103**, the point of contact between end portion **108** and notch **109**, and hinge line **46** should lie close to a straight line to reduce wear between the surfaces of end portion **108** and notch **109**. Notch **109** should lie slightly below the line extending between axis **103** and hinge line **46**.

In operation, energization of the solenoid means and reciprocal hinged movement of the flapper element **43** produces up and down motion of the outer end of the connecting pin **55** to cause restricted pivotal movement of the scissors member **106** about the scissors axis **103** and to cause the cutting blade **107** to move in a cutting action with respect to the stationary blade **104**. The amount of movement of cutting blade **107** relative to fixed blade **104** is in the order of **0.020** inches. It will be apparent that the outer end of movable blade **107** does not close with the outer end of the fixed blade **104**. When cutting through tissue layers or membranes, the fixed blade member may accurately follow guide lines or the direction in which the scissors is moved by the surgeon. The movable cutting blade **107** with each stroke cuts a very small incremental portion of the tissue layer. Since the frequency of vibration of the cutting blade relative to the fixed blade is relatively high, it will be apparent that the small incremental part of the

tissue cut on each stroke not only facilitates precise cutting, but also facilitates fairly rapid cutting.

In FIG. 5 a modification of the invention is disclosed in which the solenoid means **24** is adapted to impart linear reciprocal movement to a surgical instrument comprising a single blade as indicated at **112.** Only the difference in the construction of the holder and actuator means **10** will be described with respect to this modification for purposes of brevity and clarity.

In FIG. 5 core member **40'** and flapper element **43'** are provided with planar front and back faces normal to the axis of the holder and actuator means **10** and rocking or hinged movement of flapper element **43'** relative to the core member **40'** is not provided. Flapper element **43'** may be fixed as by welding to an axially extending pin **113** which may be spring baised in a manner similar to that of the header pin in the prior embodiment. However, in this example, pin **113** extends through the front sealing member **60'** for threaded connection at **114** with a coaxially extending adapter member **115** provided with a forwardly extending axial bore **116** having internal threads **117** for reception of the shank portion **118** of the surgical instrument blade **112.** Adjacent the end of adapter **115** the bore **116** may be provided with an outwardly flared seat **119** adapted to engage an annular rounded collar **120** provided on the shank portion **118** to limit the depth of threading of the surgical blade **112** into the adapter and to restrict and limit any lateral displacement of the blade with the adapter **115.** The instrument blade **112** may include a straight axially extending blade portion **121** having a cutting edge **122** of selected configuration.

In FIG. 5 it should be noted that the flapper element **43'** when seated against the core member **40'** under conditions of energization of the solenoid means, is permitted restricted travel in the amount of the depth of the space **125** between the front face of flapper element **43'** and the back face of the end closure member **18.** Such space normally permits approximately **0.020** inches. Thus the stroke of the blade **112** will be approximately the same as it is reciprocated at selected frequencies of for example **60** to **120** cycles per second.

It will thus be apparent that the holder and actuator means **10** is readily modified to permit linear reciprocal movement of a surgical instrument cutting blade.

Various types of surgical instrument cutting blades may be employed with the holder and actuator means **10** of this invention. In FIG. 6 a different configuration of a surgical instrument cutting blade is shown. The instrument blade **126** comprises a shank portion **127** adapted to be inserted into the blade holder or adapter **115.** The configuration of the cutting edges **128** on blade **126** is shown of V form having a point or apex **129** which may pierce the tissue layer being operated upon. With the cutting edges **128** disposed at an angle to the axis of the shank portion **127,** it will be apparent that reciprocal movement of the cutting blade **126** will produce a fine cut edge of tissue.

Double insulation for the electrical components of the holder and actuator means **10** is provided by the encapsulation of the winding **26** in the insulation **34,** the protection of the leads **30** in chamber **82** afforded by the dielectric material of the cup-shaped member **80,** and the embedment of cable **12** in a silicone or silastic material in the chambers **93** and **94** at the cable entry fitting **86.**

The holder and actuator means **10** is also constructed with close fittings and further sealed by the use of well known cementing or bonding compounds such as "Loctite." The stainless steel parts comprising the cylinder member **17** and the end closure members **18** and **19** are cemented together in sealing relation by the application of such a bonding material at the mating surface at **20** and **21.** In assembly, the internal cylinder sleeve member **36** is longitudinally positioned within the cylindrical member **17** with one end in spaced relation to end closure member **18** and is bonded to the internal surfaces of member **17** only at the other end of member **36.** Before such bonding of sleeve **36** to member **17,** precise adjustment of the close tolerances between flapper element **43,** closure **18,** and core **40** are made in a jig and held while the sleeve **36** is bonded to member **17.** After the cable **12** has been passed through the port **91** in the back end closure member **19** and has been sealed in the fitting **86,** the fitting **86** may then be cemented and sealed in the chamber **90** by such a cementing and bonding material applied to the external surfaces **130** of the fitting. It should be noted that the fitting **86** is driven fully into the chamber **90** during assembly with the end closure member **19** so that when the end closure member **19** is driven into final seated position with respect to the cylinder member **17,** the other end of fitting **86** will be partially inserted but not fully inserted within the chamber **85** of the cup-shaped member **80.**

A removable guard **131** may be used with the holder and actuator means as shown in FIG. **5.** Guard **131** is of part circular cross section and provides a support, if desired, for a finger of the surgeon's hand. The guard is removed for autoclaving the actuator means.

It should be noted that the various dielectric materials selected for the tube **29** cup-shaped member **80** and spacing discs **32** and shims **98** are also made of a heat resistant material such as Teflon or silicone. It will thus be apparent that the holder and actuator means may be subjected to the high temperatures and pressures of an autoclave or sterilization process without injuring or weakening the electrical or mechanical characteristics of the holder and actuator means. The rigid requirements for a sterile condition of surgical operating instruments is therefore met by the construction of the holder as described above.

It will be readily apparent that the actuating means for producing vibratory motion capable of being modified into a reciprocal hinged movement of limited extent or a linear reciprocal movement is provided by the actuating means of this invention described above. The actuator and holder means is fully protected by its construction and the motion generated by the actuating means is evidenced by vibratory action of the connecting pin **55** which is the only moving part projecting from the actuator and holder means **10.** Thus, by suitable design of the front end closure member **18** of the actuator and holder means may be readily adapted to various types of instruments which may require actuation by slightly different types of motion. In the examples set forth above, linear and curvilinear reciprocal motion has been described. The precise limits of such motion are controlled or regulated by the positive spacing of core element **40** with respect to the front closure member and the provision of precisely spaced stop surfaces thereon.

It will be understood that various changes and modifications may be made in the actuator and holder means described above and all such changes and modifications coming within the spirit of this invention are contemplated herein and all such changes and modifications coming within the scope of the appended claims are embraced thereby.

We claim:

1. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber therein;

actuator means for imparting cutting motion to said cutting member including

a pin adapted to be operably connected at one end with said cutting member,

a transversely disposed element connected to said pin in spaced relation to said one end and located within said chamber and movable with the pin,

said transversely disposed element being mounted for pivotal movment about an axis spaced from the axis of the pin,

said transversely disposed element comprising a disc-like element,

one face of said disc-like element being beveled from a chord line spaced from the center of the element and spaced from the axis of the pin member to provide clearance for said pivotal movement,

said disc-like element including a planar face opposite to said face having said bevel,

spring means in contact with said planar face biasing said disc-like element in the direction of said pin,

and means carried by the housing and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope.

2. In a means as stated in claim 1 wherein said motion imparting means includes an electrically actuated core exerting a force field on said disc-like element.

3. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber therein;

actuator means for imparting cutting motion to said cutting member including

a pin adapted to be operably connected at one end with said cutting member,

a transversely disposed element connected to said pin in spaced relation to said one end and located within said chamber and movable with the pin,

means carried by the housing and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope,

and means on said actuator means and on said transversely disposed element to restrain rotation of said element and said pin;

said transversely disposed element being mounted for pivotal movement about an axis spaced from the axis of the pin and perpendicular to the pin axis;

said transversely disposed element comprising a disc-like element,

one face of the disc-like element being beveled from a chord line spaced from the center of the element and spaced from the axis of the pin member to provide clearance for said pivotal movement,

said chord line locating said pivotal axis for said element.

4. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber therein;

actuator means for imparting cutting motion to said cutting member including

a pin adapted to be operably connected at one end with said cutting member,

a transversely disposed element connected to said pin in spaced relation to said one end and located within said chamber and movable with the pin,

means carried by the housing and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope,

and means on said actuator means and on said transversely disposed element to restrain rotation of said element and said pin;

said holder means including an end cap having a recessed opening through which said pin extends,

a flexible seal means seated in said recessed opening and having a cylindrical flange in said recess and a conical portion extending outwardly of the opening along said pin whereby external pressure is transmitted to said pin and cap for sealing thereof, and means on said end cap for securing one member of a scissors type cutting member.

5. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber therein;

actuator means for imparting cutting motion to said cutting member including

a pin adapted to be operably connected at one end with said cutting member,

a transversely disposed element connected to said pin in spaced relation to said one end and located within said chamber and movable with the pin,

means carried by the housing and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope,

and means on said actuator means and on said transversely disposed element to restrain rotation of said element and said pin;

said holder means including,

means providing a first stop surface to contact one face of said transverse member,

means providing a second stop surface to contact a face of said transverse member opposite to said one face,

and wherein said means to impart back and forth motion to said pin and transverse element is restricted to the precise distance between said stop surfaces and at a selected number of cycles per second,

one of said stop surfaces including a hinge line for rocking of said transverse member thereon.

6. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber therein;

actuator means for imparting cutting motion to said cutting member including

a pin adapted to be operably connected at one end with said cutting member,

a transversely disposed element connected to said pin in spaced relation to said one end and located within said chamber and movable with the pin,

means carried by the housing and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope,

and means on said actuator means and on said transversely disposed element to restrain rotation of said element and said pin;

said holder means including a housing comprising

an elongated cylinder having open ends,

end caps partially receivable in said open ends in sealing relation therewith,

one end cap having an opening for entry of electrical conduit,

fluid tight pressure seal means for said conduit in said end cap,

said other end cap having an opening for said pin,

a seal means between said pin and said end cap,

and means on the latter end cap for mounting a fixed part of an instrument.

7. In an actuator and holder means for a cutting instrument useful in microsurgery and including a cutting member, the combination of:

holder means including a housing having a chamber

therein and a longitudinal axis;

actuator means for imparting cutting motion to said cutting member including

a pin laterally offset from said axis and adapted to be operably connected at one end with said cutting member,

a transversely disposed element rigidly connected to said pin in spaced relation to said one end and located within said chamber in coaxial relation with said housing and movable with said pin,

means carried by the housing at said longitudinal axis and cooperable with said transversely disposed element to impart forward and backward motion to said pin and element whereby a cutting edge on said cutting member is imparted cutting motion of restricted scope;

and means on said actuator means and on said transversely disposed element to restrain rotation of said element and said pin;

said holder means including

means providing a first stop surface to contact one face of said transverse member,

means providing a second stop surface to contact a face of said transverse member opposite to said one face,

said means carried by said housing at said longitudinal axis to impart back and forth motion to said pin and transverse element being restricted to the precise distance between said stop surfaces and to a selected number of cycles per second.

8. In a means as stated in claim 7 wherein one of said stop surfaces is movable longitudinally of said axis relative to the other stop surface to provide precise length of travel of said transverse member and said pin.

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